REMARKS

Rejection Under 35 U.S.C. § 102(b)

Claims 1-30 are pending. Claims 1 and 22 are rejected under 35 U.S.C. § 102(b) as being anticipated by Lawrie (U.S. Patent No. 4,880, 969). Applicants respectfully traverse this rejection based on the amendments and remarks set forth herein.

Independent Claim 1 requires "a plurality of electrical components mounted to the printed circuit board; and a heatsink attached to the printed circuit board wherein the heatsink interfaces with a plurality of the electrical and optical components."

Similarly, independent Claim 22 requires "circuit board means for mounting electrical components, . . . a plurality of electrical components mounted to the circuit board means; and heatsink means attached to the circuit board means for dissipating heat from a plurality of the electrical and optical components."

In rejecting the claims, the Examiner writes in part:

> Lawrie's device discloses a printed board (26) containing mounting location[s] for optical components (switches at 12), a heatsink (58), plurality of electrical components (14, 16, 24) and other heat compliant conductive material . . . mounted on the circuit board.

Lawrie discloses structure 14 as a "programmable display module" (Lawrie, col. 5, lines 45-46), which is mounted on top of heatsink 58 (FIG. 4). The heatsink is "adjacent the printed circuit board" and placed "between the printed circuit board and the programmable display module." (Lawrie, col. 3, lines 24-30). Thus, Lawrie discloses that structure 14 is not mounted on circuit board 26 but rather on top of heatsink 58. Further, Lawrie discloses structure 24 as a "neutral density filter" that is "mounted in the lower portion of window 22" and "cemented to a bezel 17." (Lawrie, col. 5, lines 32-34; FIG. 4). Thus, Lawrie discloses that structure 24 is not mounted on circuit board 26. Applicants cannot find any disclosure on structure 16 in the written specification of Lawrie. However, even if structure 16 is assumed to be an electrical component, FIG. 2 of Lawrie discloses that structure 16 is not mounted on circuit board 26. (Lawrie, FIG. 2). Accordingly, Lawrie does not disclose or suggest

electrical components that are mounted on the printed circuit board, as required in Claims 1 and 22.

In addition, Lawrie only discloses that the heat sink is "between the printed circuit board and the programmable display module to sink heat therefrom [the display module]." (Lawrie, col. 3, lines28-30). Further, Lawrie discloses that the "keyswitch of the present invention preferably has the light source mounted to the printed circuit board such that the first optical path passes through an opening in the heat sink. The detector is preferably mounted to the printed circuit board such that the third optical path passes through a third one of the plurality of openings in the heat sink." (Lawrie, col. 3, lines 40-46). "All of the electrical connections to light source 32, detector 34 and programmable display module 14 may be accomplished with connection 60 so that no wiring or other electrical connections are required in interactive optical keyswitches 12." (Lawrie, col. 5, lines 44-48). Electrical connections 60 "project through a slot 62 in heatsink 58 from printed circuit board 26 to each interactive optical keyswitch 12. (Lawrie, col. 5, lines 41-44). Accordingly, Lawrie does not disclose or suggest a heatsink attached to the printed circuit board wherein the heatsink interfaces with or dissipates heat from a plurality of electrical and optical components, as required in Claims 1 and 22. Therefore, independent Claims 1 and 22 are distinguishable from Lawrie for at least these reasons and allowance is respectfully requested.

Claims 2-9 ultimately depend upon Claim 1, and Claims 23-30 ultimately depend upon Claim 22, and include additional limitations which further distinguish them from Lawrie and Fujiwara, alone or in combination. Therefore, Claims 2-9 and 23-30 are allowable for at least the same reasons as Claims 1 and 22, respectively.

Rejection Under 35 U.S.C. § 103(a)

Claims 2-21 and 23-30 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Lawrie in view of Fujiwara (JP patent 356019682).

The Examiner states that "[f]or 2-7 and 23-28, Lawrie's device...fails to explicitly disclose the heatsink with opening to embed the optical components. Fujiwara's device discloses a groove (6) to embed an optical fiber. It would have been obvious at the time the

invention was made to a person having ordinary skill in the art to add the opening to the heat sink to embed the optical component such as the one taught in Fujiwara's structure for improving the interconnectivity of Lawrie's device." (Office Action, paragraph 2, page 3.) Applicant respectfully submits that these statements do not supply rationale for rejecting the individual feature of claims 2-7 and 23-28. Applicants respectfully request a more complete statement of the Examiner's rationale for rejecting the features and limitations of claims 2-7 and 23-28.

Notwithstanding Applicant's objection to the incomplete grounds for rejecting claims 2-7 and 23-28, Applicant respectfully traverses the rejection of Claims 2-7 and 23-28. To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). See MPEP § 2143.

Applicants respectfully submit that the combination of the Lawrie and Fujiwara references do not teach or suggest all the claim limitations. Further, there is no teaching or motivation to modify the Lawrie and Fujiwara references or to combine the teachings of Lawrie and Fujiwara.

For at least the reasons set forth hereinabove for Claims 1 and 22, Lawrie does not disclose or suggest electrical components that are mounted on the printed circuit board, as required in Claims 1 and 22. Lawrie also does not disclose or suggest a heatsink attached to the printed circuit board wherein the heatsink interfaces with or dissipates heat from a plurality of electrical and optical components, as required in Claims 1 and 22.

Applicant further respectfully submits that Fujiwara does not disclose or suggest a tray mounted on a printed circuit board for routing optical fiber, as required in Claims 2, 11, and 17. The Examiner states that Fujiwara discloses a groove (6) in a semiconductor substrate to

embed an optical fiber. The semiconductor substrate is a light receiving element. Applicant submits that the groove in the light receiving element (semiconductor substrate) of Fujiwara cannot be compared to the claimed tray mounted on a printed circuit board. A groove cut into a substrate cannot be considered to be "mounted" on a structure; it is integral to the structure into which it is cut. The claimed tray, as shown for example in Fig. 3, is a separate structure that is mounted on a printed circuit board. Further, the light receiving element is not a printed circuit board. Therefore, Fujiwara discloses neither a tray or a printed circuit board. The combination of Lawrie and Fujiwara therefore do not teach or suggest all the claim limitations of Claims 2, 11, and 17.

Claims 2-7 ultimately depend upon Claim 1, and Claims 22-28 ultimately depend upon Claim 22, and include additional limitations which further distinguish them from Lawrie and Fujiwara, alone or in combination. Therefore, Claims 2-9 and 23-30 are allowable for at least the same reasons as Claims 1 and 22, respectively.

In rejecting dependent Claims 8-9 and 29-30, the Examiner writes in part that "Lawrie's and Fujiwara's devices...fail to explicitly disclose the location of the optical and electrical components on the circuit board which is an obvious variation...since...rearranging parts of an invention involves only routine skill in the art." (Office Action, paragraph 2, page 3). Applicant submits that an advantage of positioning transmit and receive components in separate areas is to improve isolation, thereby reducing noise among the components. (See specification, at least page 7, lines 18-24). Therefore, choosing the position of the optical and electrical components is not merely rearranging parts of an invention or an obvious variation. Claims 8-9 and 29-30 are therefore allowable for at least this reason.

In rejecting independent Claims 10 and 16, the Examiner writes in part that "Lawrie's and Fujiwara's devices disclose the aforementioned limitations, the method claims are inherent because they contain all the limitations of the apparatus claims."

Claim 10 requires "determining an average height of the electrical components and the optical components with respect to the printed circuit board; . . . embedding the at least some of the significantly higher electrical components and optical components in the openings in the printed circuit board; and attaching a heatsink member to the printed circuit board so that

the heatsink member is in contact with at least a portion of each electrical and optical component that requires cooling."

Similarly, Claim 16 requires "determining an average height of the electrical components and the optical components with respect to the printed circuit board; . . . positioning the heatsink over the significantly higher electrical components and optical components on the printed circuit board; and attaching a heatsink member to the printed circuit board so that the heatsink member is in contact with at least a portion of each electrical and optical component that requires cooling."

For at least reasons similar as those provided above with respect to Claims 1 and 22, Applicants additionally submit that Lawrie and Fujiwara, alone or in combination, do not disclose or suggest all the limitations of Claims 10 and 16. For example, Lawrie and Fujiwara, alone or in combination, do not disclose or suggest embedding at least some of the significantly higher electrical components in the openings in the printed circuit board, as required in Claim 10, or placing them on the circuit board, as required in Claim 16. Further, Applicants submit that Lawrie and Fujiwara, alone or in combination, do not disclose or suggest attaching a heatsink member to the printed circuit board so that the heatsink member is in contact with at least a portion of each electrical and optical component that requires cooling, as required in Claims 10 and 16. In addition, Lawrie and Fujiwara, alone or in combination, do not disclose or suggest determining an average height of the electrical and optical components with respect to the printed circuit board, as required in Claims 10 and 16. Therefore, independent Claims 10 and 16 are distinguishable from Lawrie and Fujiwara, alone or in combination, and allowance is respectfully requested.

Claims 11-15 depend upon Claim 11, and Claims 17-21 ultimately depend upon Claim 16, and include additional limitations which further distinguish them from Lawrie and Fujiwara, alone or in combination. Therefore, Claims 11-15 and 17-21 are allowable for at least the same reasons as Claims 10 and 16, respectively. Allowance of Claims 11-15 and 17-21 is respectfully requested.

Claims 31-37 are added to claim subject matter to which Applicants believe they are entitled.

CONCLUSION

In view of the remarks set forth herein, Claims 1-37 are believed to be allowable over the cited references. The application is believed to be in condition for allowance, and a notice to that effect is solicited. Nonetheless, should any issues remain that might be subject to resolution through a telephonic interview, the Examiner is requested to telephone the undersigned.

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ATTACHMENT A

The replacement paragraphs with markings showing the changes are as follows:

The paragraph beginning on Page 4, line 3, and ending on Page 4, line 15, is amended as follows:

Fig. 2 illustrates a 3-dimensional isometric view of one embodiment of the invention with heatsink 110 shown in exploded view. **Fig. 2** shows a plurality of electrical and optical components which enable transmission and reception of data at the OC-192 rate. Modulator/driver 130 is connected via semi-rigid coaxial cable 114 to external modulator 262. In one embodiment, modulator/driver 130 provides amplification of digital signals received from electrical components on PCB 100 and produces [an] a 7 volt peak to peak signal which is received, via semi-rigid coaxial cable 114, by external modulator 262. In one embodiment, external modulator 262 is a commercially available titanium-diffused lithium niobate modulator. Distributed feedback (DFB) laser 250 is used in conjunction with external modulator 262 that incorporate gratings to compensate for the dispersion of the optical signals. In one embodiment, DFB laser 250 operates in the 1555-1560 nanometer range and produces 40 milliwatts minimum of optical output power.

The paragraph beginning on Page 7, line 18, and ending on Page 7, line 24, is amended as follows:

Another feature of the present invention is that transmit and receive components are positioned in separate sections to improve isolation, thereby reducing noise. For example, in the embodiment shown in **Fig. 2**, receive components including 1:16 demultiplexer 210, 16:64 demultiplexer 220, and amplifier 222, are positioned on one side of PCB 100, while transmit components including 64:16 multiplexer, 16:1 multiplexer, and modulator driver preamp 240 are positioned on the other side of PCB 100.

The paragraph beginning on Page 7, line 25, and ending on Page 7, line 28, is amended as follows:

Another feature of the assembly shown in **Fig. 2** is that components that are highly sensitive to temperature variations are positioned on PCB 100 so that they receive the largest volume and lowest temperature of cooling air. These components include, for example, modulator driver 130, and DFB laser 250.

The paragraph beginning on Page 8, line 1, and ending on Page 8, line 8, is amended as follows:

Another feature of the present invention is that the layout of PCB 100 provides space and is adaptable for using components from a number of suppliers. For example, adequate clearance space is provided on PCB 100 to accommodate the largest modulator driver available, and modulator drivers from other manufacturers will thus also fit in the space. It is important to note that if the opening in heatsink 110 is too large for the corresponding component, heat conductive material may be added around at least a portion of the perimeter of the opening so that heatsink 110 comes into contact with the component.

ATTACHMENT B

The amended claims with markings showing the changes are as follows:

1. (Amended) A printed circuit board assembly for high-speed optical format data transmission comprising:

a printed circuit board **[containing mounting locations for electrical components, optical components, and a heatsink device]**;

a plurality of optical components mounted to the printed circuit board;

a plurality of electrical components mounted to the printed circuit board; and

a heatsink attached to the printed circuit board wherein the heatsink interfaces with a plurality of the electrical and optical components.

16. (Amended) A method for dissipating heat from electrical components and optical components on a printed circuit board, the method comprising:

determining an average height of the electrical components and the optical components with respect to the printed circuit board;

forming openings in a heatsink corresponding to at least some of the electrical components and optical components that are significantly higher than the average height;

positioning the heatsink over the significantly higher electrical components and optical components **[in the openings in]** **on** the printed circuit board; and

attaching a heatsink member to the printed circuit board so that the heatsink member is in contact with at least a portion of each electrical and optical component that requires cooling.

22. (Amended) A device for high-speed optical format data transmission comprising:

circuit board means for mounting electrical components, optical components, and a heatsink device;

a plurality of optical components mounted to the circuit board means;

a plurality of electrical components mounted to the circuit board means; and

heatsink means attached to the **[printed]** circuit board **means** for dissipating heat from a plurality of the electrical and optical components.

Please add the following claims:

31. (New) An apparatus comprising:

a printed circuit board;

an optical component mounted to the printed circuit board, wherein the optical component is operable to receive a digital data signal;

an electrical component mounted to the printed circuit board, wherein the optical component is operable to receive the digital data signal; and

a heatsink attached to the printed circuit board wherein the heatsink interfaces with the electrical component and the optical component.

32. (New) The apparatus of claim 31, further comprising a tray mounted on the printed circuit board for routing optical fiber.

33. (New) The apparatus of claim 31, wherein the electrical component is embedded in an opening in the printed circuit board.

34. (New) The apparatus of claim 31, wherein the optical component is embedded in an opening in the printed circuit board.

35. (New) The apparatus of claim 31, wherein the electrical component is embedded in an opening in the heatsink.

36. (New) The apparatus of claim 31, wherein the optical component is embedded in an opening in the heatsink.

37. (New) The apparatus of claim 31, wherein the height of the electrical component and the optical component is substantially the same on one side of the printed circuit board, the heatsink is attached to the one side of the circuit board, and the heatsink interfaces with at least the top of the electrical component and at least the top of the optical component.

38. (New) The apparatus of claim 31, wherein the heatsink further includes cooling fins.

39. (New) The apparatus of claim 31, wherein material is removed from the bottom of one or more portions of the heatsink to accommodate one or more of the electrical or optical components.

ATTACHMENT C

The Abstract with markings showing the changes is as follows:

An assembly, method, and device for high-speed optical format data transmission includes a printed circuit board containing mounting locations for electrical components, optical components, and a heatsink device. A tray may also be mounted on the printed circuit board to route optical fiber to various components. The heatsink is positioned at a predetermined height above the printed circuit board so that it physically contacts the electrical and optical components that require cooling. The printed circuit board may include one or more openings in which one or more of the electrical or optical components that are significantly taller than the other components are embedded. The heatsink may also include one or more openings in which one or more of the taller electrical or optical components are positioned. Additional compliant heat conductive material may be placed between the top of one or more electrical or optical components and the heatsink when the components are not as high [at] as the position of the heatsink. Material may also be removed from the bottom of one or more portions of the heatsink to accommodate one or more of the electrical or optical components that are slightly higher than the position of the heatsink. The layout of the printed circuit board assembly includes positioning the electrical and optical components for receiving data on one section of the printed circuit board, while the electrical and optical components for transmitting data are positioned on another section of the printed circuit board. The electrical and optical components that are sensitive to temperature variation are positioned near the portion of the printed circuit board that receives the greatest amount of cooling.